Center Innovation Fund: JSC CIF

Acoustic Emission Health Monitoring of Fill Purge COPV's Used in Aerospace and Automotive Applications and Designed for Long Cycle Life

Completed Technology Project (2013 - 2013)

Project Introduction

Abstract

Problem Description: Cumulative composite damage in composite pressure vessels (CPVs) currently is not monitored on-orbit. Consequently, hazards due to catastrophic burst before leak (BBL) or compromised CPV reliability cannot be ascertained or mitigated, posing a risk to crew and mission assurance. The energy associated with CPV rupture can be significant, especially with high pressure gases are under containment, and the energy releases can be severe enough to cause injury, death, loss of assets or mission.

Dual-Use Rationale: CPVs similar to those used by NASA on ISS, for example, are finding increasing use in automotive and transportation industry applications. These CPVs generally have a nonload sharing liner and are repeatedly filled over their service lifetime, typically with hydrogen or compressed natural gas (CNG). The same structural health monitoring equipment and software developed by NASA WSTF for evaluating, in real-time, the health of NASA CPVs on ISS will be used to evaluate the health of automotive CPVs, the only differences being the type and design of the CPV, and the in-service lifetime pressure histories.

HSF Need(s)/Performance Characteristic(s) Supported:

1) Enable on-board vehicle systems management for mission critical functions at destinations with > 3 second time delay

2) Enable autonomous nominal operations and FDIR for crewed and un-crewed systems

3) Reduce on-board crew time to sustain and manage vehicle by factor of 2x at destinations with > 6 second time delay (see Crew Autonomy sheet)

4) Reduce earth-based mission ops “back room engineering” requirements for distant mission support delay (see Mission Autonomy sheet)>

Anticipated Benefits

CPVs similar to those used by NASA on ISS, for example, are finding increasing use in automotive and transportation industry applications. These CPVs generally have a nonload sharing liner and are repeatedly filled over their service lifetime, typically with hydrogen or compressed natural gas

Project Image Acoustic Emission Health Monitoring of Fill Purge COPV's Used in Aerospace and Automotive Applications and Designed for Long Cycle Life

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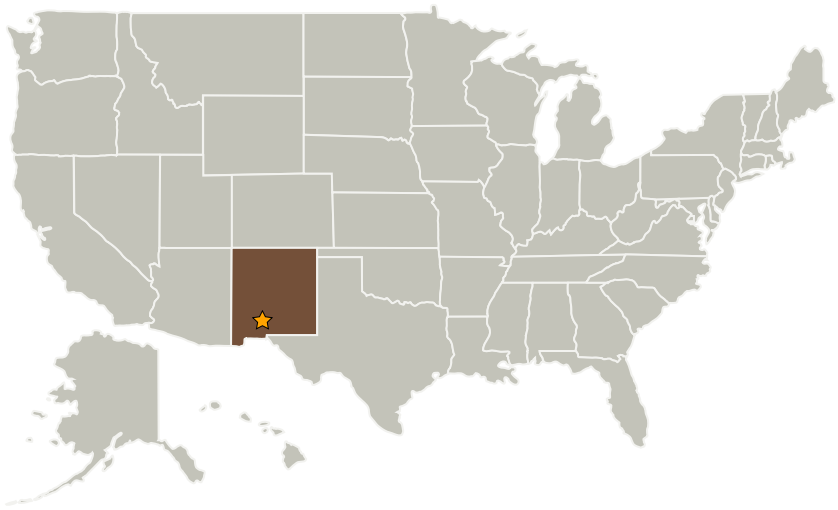
(CNG). The same structural health monitoring equipment and software developed by NASA WSTF for evaluating, in real-time, the health of NASA CPVs on ISS will be used to evaluate the health of automotive CPVs, the only differences being the types of CPV (test article) being evaluated, and the in-service lifetime pressure histories.

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★White Sands Test Facility(WSTF)	Lead Organization	NASA Facility	Las Cruces, New Mexico
GeoControl Systems, Inc.	Supporting Organization	Industry	
Jacobs Engineering Group, Inc.	Supporting Organization	Industry	Dallas, Texas

Primary U.S. Work Locations
New Mexico

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

White Sands Test Facility (WSTF)

Responsible Program:

Center Innovation Fund: JSC CIF

Project Management

Program Director:

Michael R Lapointe

Program Manager:

Carlos H Westhelle

Project Manager:

Jess M Waller

Principal Investigator:

Jess M Waller

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Images

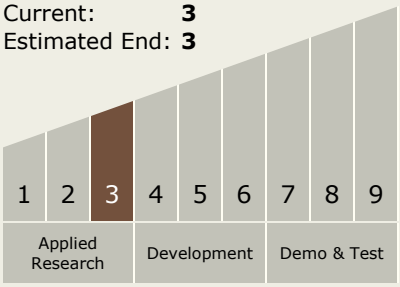
12137-1385097402429.jpg
Project Image Acoustic Emission Health Monitoring of Fill Purge COPV's Used in Aerospace and Automotive Applications and Designed for Long Cycle Life
(https://techport.nasa.gov/image/2386)

Links

Patent Link 1
(https://ntr.ndc.nasa.gov/ntr/viewTech.html?fn=/data/other/review_bin/technology/accepted/c3ab2865_a6d6_45e2_8a55_95d3ee9ba2a2.xml)

Technology Maturity (TRL)

Start: **3**
Current: **3**
Estimated End: **3**



Technology Areas

Primary:

- TX06 Human Health, Life Support, and Habitation Systems
  - TX06.3 Human Health and Performance
    - TX06.3.3 Behavioral Health and Performance